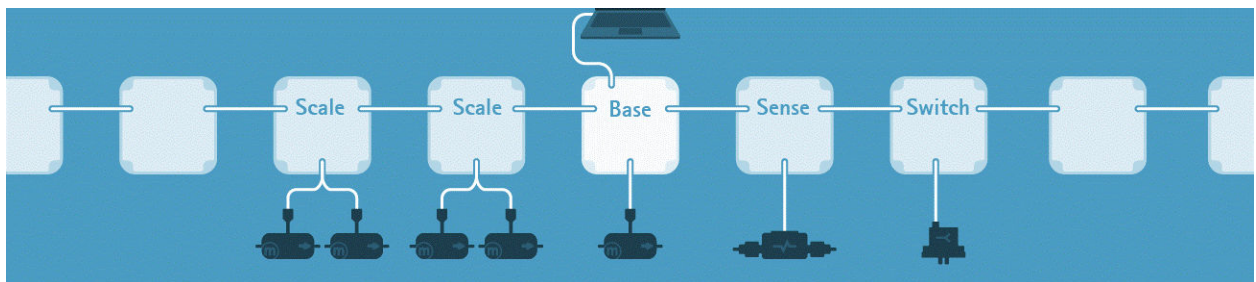


Bartels FluidCube and FluidicStudio Manual

Version 1.0



08 October 2026 | Version 1.0

Revision History

Version	Date	Revision
1.0	08 October 2026	Initial publication.

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1 Quick Start

What You Need

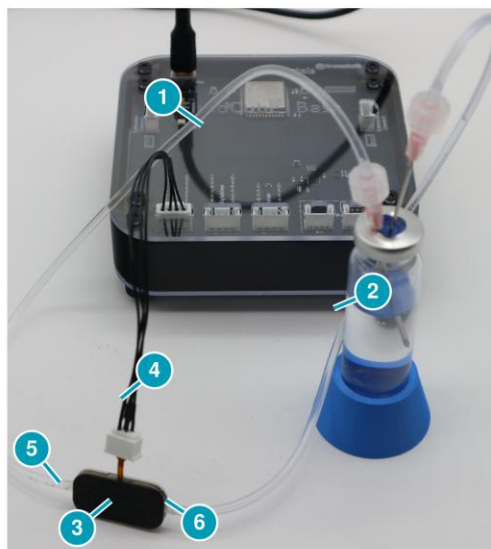
This Quick Start uses FluidCube | Base Rev1, one BP7 pump, an mp-Lowdriver, FluidCube | Pump Cable, a USB-A-to-USB-C data cable, water, Tygon tubing with 1.3 mm internal diameter, a reservoir and a priming syringe. Base is required when Extensions are added.

Component	Purpose
Computer with FluidicStudio v2.0.0	Central software interface.
FluidCube Base	Central control and communication unit.
Supplied USB-A-to-USB-C data cable	Power and data connection to Base.
FluidCube Pump Cable	Connects a compatible pump to Base or Scale.
BP7 pump with mp-Lowdriver	Pumping component for the application.
Water, reservoir and Tygon tubing	1.3 mm internal diameter; inlet and outlet in the same reservoir.
Syringe	Draw water through the pump from its outlet until no bubbles emerge.

Download FluidicStudio v2.0.0 from <https://bartels-mikrotechnik.de/support-center/>. It is supplied as an .msix installer. Base firmware reference: 20261007. A PC USB data connection is sufficient for this one-pump setup.

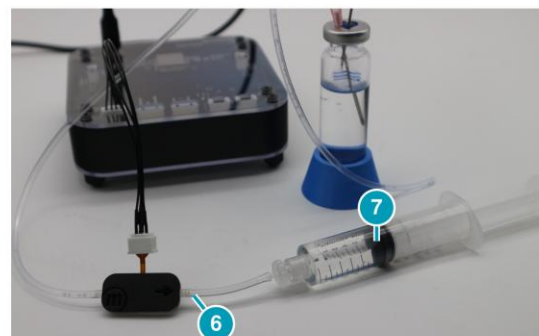
Base is supplied without a pump driver. Have the mp-Lowdriver, BP7 and all components listed above available before assembly. Read the handling precautions in Section 3.

A Quick Start setup



- 1 FluidCube | Base / USB to PC
- 3 BP7 pump
- 5 Inlet

B Prime from the outlet



- 2 Water reservoir
- 4 Pump Cable
- 6 Outlet
- 7 Syringe: draw water through the pump

Figure 1. Quick Start setup and priming the BP7 pump from the outlet.

FluidicStudio is available for Windows. Custom software using Serial Commands is an alternative for normal control; see Chapter 9.

Connect Your FluidCube

1. Disconnect the PC and every external supply from the complete setup. Wait a few seconds before accessing drivers or changing cables. Observe ESD precautions.

2. Remove the bottom plate and install the mp-Lowdriver in the leftmost socket when viewed from above. Match the driver dot to the socket triangle. The socket is labelled on both sides of the PCB. An IC tool is recommended. Refit the bottom plate. See Figure 5, Panel B, for the installed Lowdriver and orientation detail.

3. Connect the Pump Cable to the "Pump" connector directly below the Lowdriver socket, then connect the BP7. Use the approved pump connection illustration: the flex-cable contact faces point away from the side with the four openings in the white connector.

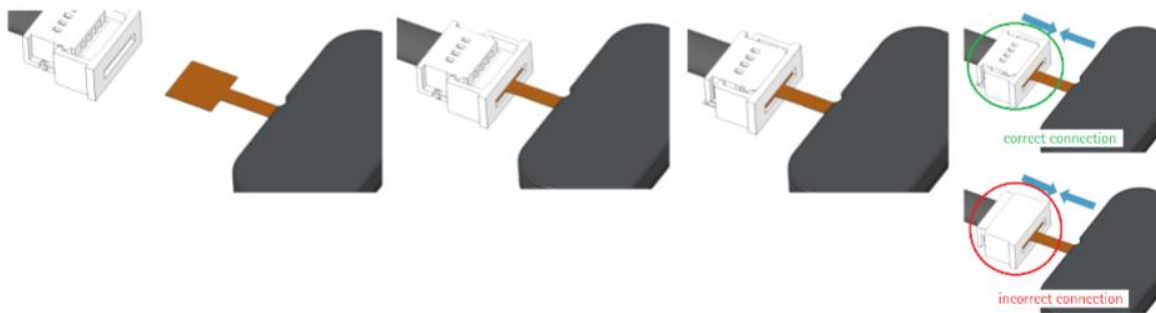
4. Connect inlet and outlet tubing to the BP7. Place the inlet in the water reservoir. Attach the syringe to the outlet tubing and draw water through the pump until no air bubbles are drawn out. Remove the syringe and return the outlet tube to the same reservoir.

5. Establish all component and Grove connections before applying power. Connect the supplied USB data cable from the PC to Base. If supplemental supplies are used, connect them after the PC connection.

Use water with the BP7/mp-Lowdriver combination. This Quick Start does not require a flow sensor or a pressure branch.

Priming may be performed with the Pump Cable connected and power applied. Do not connect or disconnect electrical cables while power is applied.

Do not change drivers, component cables, Grove cables or address switches while powered. Disconnect all supplies and the PC first. Do not handle ICs or assemblies with bare hands without grounding; electrostatic discharge can damage them.



Correct BP7 flex-cable connection: the contact faces point away from the side with the four openings in the white connector, as shown by the green-marked connection.

[Connect to FluidicStudio](#)

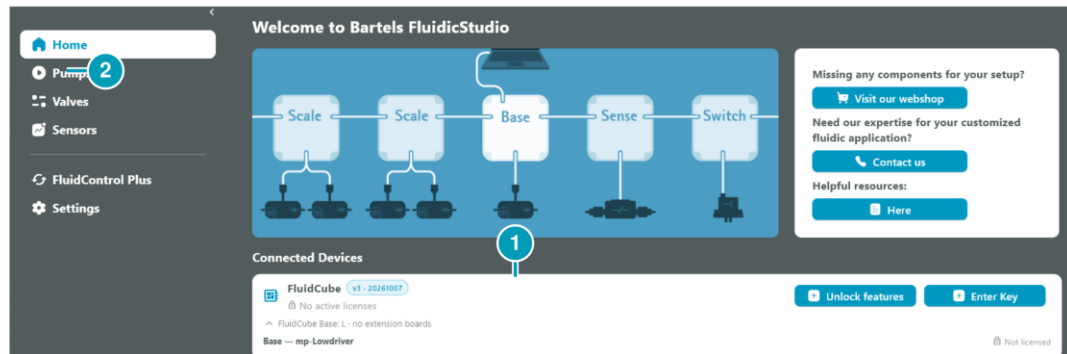
Bartels FluidicStudio manages the connected FluidCube system through FluidCube | Base. Extensions are accessed through Base rather than used as independent software devices.

A Select the COM port

COM port numbers may vary.



B Connected Base and detected components



1 Connected Devices overview

2 Pumps navigation

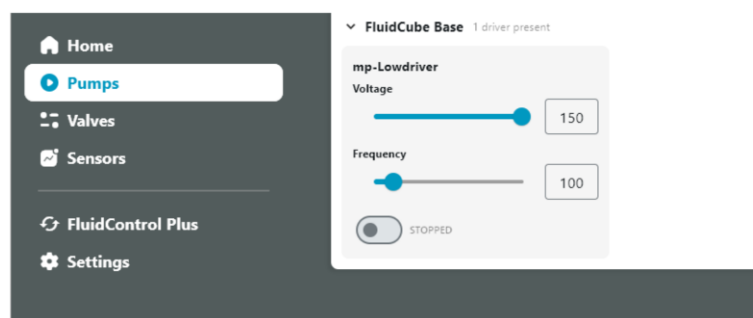
Figure 2. Connecting FluidCube and viewing detected components in FluidicStudio.

Start FluidicStudio and choose Connect. Select the correct COM port; the connected Base appears as a tile at the top. Home lists detected boards, drivers and sensors. Use the pages in the left navigation for operation. First Connect after a full power-cycle does not activate pumps or valves.

Run Your First Pump

Open "Pumps" in the left navigation. Only detected drivers are displayed in the pump tile. Use the Lowdriver entry for this example.

Set amplitude to 150 Vpp and frequency to 100 Hz using the sliders or input fields. Press the on/off button to start the pump. A quiet hum can be heard. Lift the outlet tube end out of the reservoir: droplets forming at the end show pumping. Press the same button to stop.



Voltage: 150 Vpp Frequency: 100 Hz

Use the on/off control to start or stop the pump.

Figure 3. Operating the BP7 with the mp-Lowdriver at 150 Vpp and 100 Hz.

For this first-pump workflow use the manual controls on "Pumps". Sensor measurements and licensed regulation are separate workflows described in Sections 8.5 and 8.7.

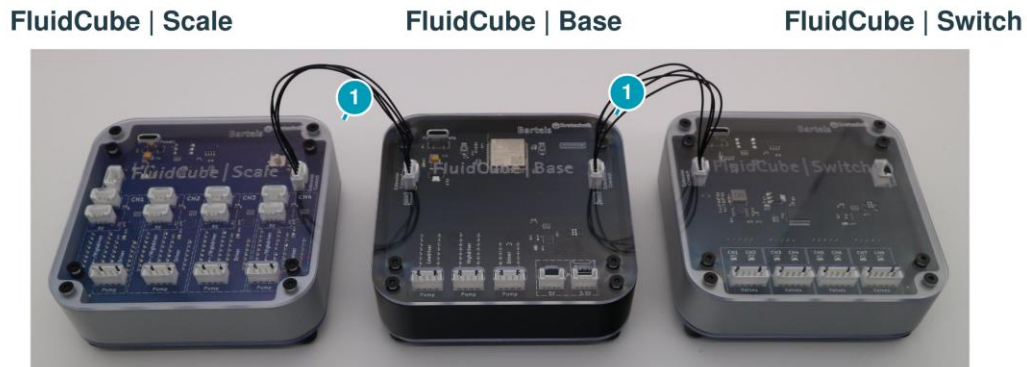
There is no central stop-all button. Stop individual functions manually or disconnect the PC and all supplies for a full power-cycle. USB disconnection alone does not stop externally powered hardware: pumps, regulation, dosing and valve actuation can continue. After a full power-cycle pumps, regulation and dosing remain off until started. Load can automatically restore active pump and valve states; read Section 8.3 before using it.

Expanding Your Setup

Add FluidCube | Scale for additional pumping capability and pressure/flow sensing, FluidCube | Switch for valve control and fluid routing, or FluidCube | Sense for analytical sensing. Every expanded configuration continues to require Base. See Chapters 3 and 5–7.

Set each Extension to a unique address from 0 to 7 before applying power. Uniqueness applies across Scale, Switch and Sense on the same Base. A repeated address may result in only one or neither affected Extension being detected.

Use 4-pin Grove cables from Seeed Studio to daisy-chain the Extension ports. Both ports are equivalent. Connect and disconnect Grove cables only with the entire setup unpowered. Do not adjust the rotary address switch during operation.



1 4-pin Grove cables

Set a unique Extension address before applying power.

Figure 4. Connecting Scale and Switch Extensions to FluidCube | Base using 4-pin Grove cables.

2 The FluidCube Ecosystem

What Is FluidCube?

Bartels FluidCube is a modular Fluidic Development Platform for application-specific fluidic development setups. Start with Base and combine specialized Extensions when additional pumping, valve control or analytical sensing is needed. Modularity allows the configuration to be expanded as application requirements change.

System Architecture

FluidCube | Base is the central control and communication hub. Extensions are configured and controlled through Base. They are not standalone customer setups; previously started functions can continue while powered if the PC connection is lost.

Unit	Role
FluidCube Base	Mandatory central control and communication; pump and pressure/flow sensing functionality.
FluidCube Scale	Additional pump capability and pressure/flow sensing.
FluidCube Switch	Valve control and configurable fluid routing.
FluidCube Sense	Sensor acquisition including CO ₂ /VOC and compatible pressure/flow; no Fluid Control Plus regulation.
FluidCube Pump Cable	Connection of a compatible pump to Base or Scale.

FluidCube can also be controlled from custom software using the documented Serial Commands. FluidicStudio is used to activate board-bound Fluid Control Plus licenses; licensed regulation can then be addressed through Serial Commands.

Building Your FluidCube Configuration

Choose Base/Scale for pumping and channel-associated regulation, Switch for valve control, and Sense for extended sensor acquisition. Sense can also read compatible pressure/flow sensors; it does not support Fluid Control Plus regulation.

Application requirement	Conceptual configuration
Basic pumping	Base + Pump Cable + compatible pump.
Additional pumping and pressure/flow sensing	Base + Scale + compatible components.
Valve control and fluid routing	Base + Switch + compatible valves.
Analytical sensing	Base + Sense + compatible analytical sensors.
Combined functions	Base + selected specialized Extensions.

Choose components and supply for the functions needed in your setup.

Sense can also read compatible pressure and flow sensors. These sensors are normally connected to Base or Scale when used for regulation. A sensor-only configuration with Base and Sense is supported; no pump is required.

Scaling and Multiplexing

Scale adds pump channels, Switch controls valves for external fluid routing, and Sense adds sensor channels. This guide covers basic setup and the functions described here; large-system timing and multiplexing reference details are outside its scope.

Base has three separate pump connections, one per driver socket. Each Scale adds four pump channels and each Sense four sensor channels. These counts are not a maximum system-size or performance rating.

3 General Information

System Components

Product	Article number	System dependency
FluidCube Base	BM-E-0018	Required in every configuration.
FluidCube Scale	BM-E-0019	Operates through Base.
FluidCube Switch	BM-E-0020	Operates through Base.
FluidCube Sense	BM-E-0021	Operates through Base.
FluidCube Pump Cable	BM-A-0067	Connects a compatible pump to Base or Scale.

Use the supplied USB-A-to-USB-C data cable for PC connection. Other USB-C data cables supporting 5 V are allowed. Extension connections use 4-pin Grove cables from Seeed Studio. Pump connections use the single FluidCube | Pump Cable variant. Valve cable variants are specific to the valve manufacturer/connector.

Mechanical Design

The boards share a square form and have feet and a transparent cover. Base has a black housing; the Extensions have a white surround. Components such as pumps, sensors and valves connect by cable to the designated board connections.

Drivers are reached through the removable bottom plate. Keeping the plate fitted during use is recommended to reduce access to the drivers. Clean the exterior with a dry or slightly damp cloth.

User-installed pump and valve drivers are accessed through the removable bottom plate. Sense requires no driver installation or opening of its bottom plate for sensor connection.

Power Supply and Communication

Base provides the central computer interface. Its USB-C connection carries power and data. The board-connection cables link Base with the Extensions. Software control of the complete configuration is performed through Base.

Use 5-V USB-C supplies rated at least 0.5 A where supplemental power is needed. Switch also accepts a 12-V USB Power Delivery profile. A fully populated Switch requires a suitable 12-V / at least 2-A PD supply; a suitable product is available in the Bartels shop. Solenoid valves require 12 V. SMA valves can be operated using the 5-V supply or the shared 12-V PD supply.

Supplemental power need depends on Extensions, connected components and operating settings. Prefer adding supply to the highest-consumption board; in long chains also consider the furthest Extensions. General consumption order: valves, pumps, sensors. Excess load can trigger a Base brownout: Base may not start, be detected by the PC or connect in the app. These symptoms alone do not uniquely diagnose brownout.

PC and external supplies may be connected simultaneously. First make component/Grove connections while fully unpowered, then connect PC USB, then external supplies. If USB is disconnected while supply remains, the hardware continues with its last settings. Regulation retains the last target; a started dosing sequence continues; valves retain their last state. No hardware-state mirroring is performed when reconnecting to the app.

Connecting Extensions

Daisy-chain Base and Extensions through the equal Extension ports using 4-pin Grove cables. Set unique addresses 0–7 while unpowered. Establish or remove Grove connections only after disconnecting PC and all external supplies and waiting a few seconds. See Figure 4 for an example connection.

For an address collision, disconnect the PC and all external supplies, wait a few seconds, assign distinct addresses, then reconnect the PC followed by external supplies. Connect Base again in FluidicStudio.

The rotary address selector is reachable from the underside. Never change it during powered operation. Each Extension address must be unique within its Base environment, including between different Extension types.

System Configurations

A setup includes Base plus the Extensions needed for its function. For example, add Scale for more pumps, Switch for valves or Sense for sensor acquisition.

Both Extension ports are equivalent; there is no prescribed input/output direction.

Safety, Intended Use and Product Status

This guide covers Base Rev1, Scale Rev1, Switch Rev0 and Sense Rev0 with FluidicStudio v2.0.0 and Base firmware 20261007. Revision numbers are printed on the PCB underside.

Before removing the bottom plate or changing drivers or cables, disconnect the PC and all external supplies; wait a few seconds. Observe ESD precautions and do not touch assemblies or ICs with bare hands without grounding. Driver electronics involve high voltage. Keeping the bottom plate fitted is recommended; do not touch or remove powered drivers. Set Extension addresses only while unpowered.

The housing is not sealed; liquids can enter. If liquid enters, disconnect the PC and all power sources. Components may become hot after a short circuit; allow them to cool before contact. If abnormalities occur, have the board inspected by Bartels. This guide does not provide a liquid-ingress repair, oven-drying or return-to-service procedure.

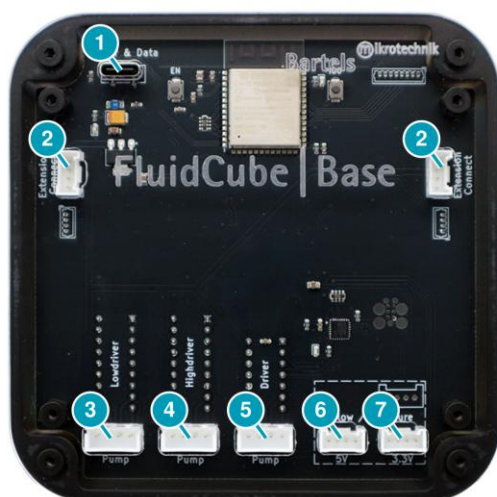
For the BP7, the confirmed media and ambient temperature range is 0 to +70 °C. The supported memetis/Takasago SMA valves have a maximum of +50 °C for media and ambient temperature. These component values do not establish an overall FluidCube operating range. Follow the documentation for the connected components.

4 FluidCube | Base

Overview

Mandatory central system control and communication. Base connects the computer/software interface with the FluidCube configuration and supports pumping and pressure/flow sensing.

A Base Rev1: top



- 1 Power & Data (PC USB)
- 3 Lowdriver / Pump
- 5 Driver / Pump
- 7 3.3V sensor connection
- 9 Driver dot aligned with socket triangle

B Underside: mp-Lowdriver installed



- 2 Extension Connect
- 4 Highdriver / Pump
- 6 5V sensor connection
- 8 Installed mp-Lowdriver

Orientation detail

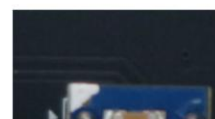


Figure 5. FluidCube | Base connections and pump-driver orientation.

Base also provides a platform for evaluating Driver, Lowdriver and Highdriver choices before using the selected driver in the application. The Quick Start is a representative standard setup.

Connections and Controls

Use the connector labels and assignments below.

Connector / control	Location / identification	Function / connection
Power & Data	USB-C-shaped port	PC USB power and data for basic setup; supplied USB-A-to-USB-C cable.
Extension Connect	Connections on both sides	Equal Extension ports; 4-pin Seeed Studio Grove cables; changes only unpowered.
Lowdriver / Highdriver / Driver; Pump	Three labeled areas/three visible pump sockets	Three independent driver/pump connections: left Lowdriver, middle Highdriver, right Driver. All may be populated and pumps run in parallel.
Flow / Pressure; 5V / 3.3V	Two front sensor sockets and a further labeled footprint	SLF3S-0600/-1300 at 3.3V; ABPMANV015PG7A5 and SDP810-125Pa at 5V. Digital I2C.

Base has three sockets and corresponding pump connectors. Viewed from above: left mp-Lowdriver, middle mp-Highdriver, right mp-Driver. All are labelled on both PCB sides and may be populated together; pumps can run in parallel. A Power LED indicates supply.

Connecting Components

Use FluidCube | Pump Cable to connect a compatible Bartels micropump to a designated pump connection. Pressure and flow sensors are connected using the approved cables for the selected compatible models.

Connect Pump Cable to the "Pump" connector corresponding to the installed driver. At the pump connector orient flex contacts opposite the white-connector side with four openings, as in the connection illustration. SLF3S-0600/-1300 use the "3.3V" Grove port; Honeywell ABPMANV015PG7A5 and Sensirion SDP810-125Pa use "5V". Connect sensors before applying supply.

Install drivers while fully unpowered with the dot aligned to the socket triangle. Do not reverse the driver. A usable channel has an installed, identified driver. Only detected drivers are displayed in the app.

Operation and Functionality

Base provides the central interface for all connected boards and their adjustable parameters. Pump operation and pressure/flow sensor readout are managed in FluidicStudio. Extensions expand the available functions while keeping control centralized through Base.

Base can operate the three connected pumps in parallel. Pressure and flow sensing are available through the designated sensor ports. Regulation requires the relevant driver, sensor and hardware-bound license; see Section 8.7.

For regulation, the sensor must be connected to the same Base as the controlled pump. Sensors on Sense or another board cannot be freely reassigned to that controller.

Example Configuration

Computer with FluidicStudio + Base + Pump Cable + compatible micropump.

Use the concrete water/BP7/mp-Lowdriver setup in Chapter 1 as the pumping example. Add a compatible sensor only for the relevant sensing or regulation workflow.

Technical Specifications

Property	Specification
Article number	BM-E-0018
System role	Mandatory central system control and communication.
Compatible components / channel capacity	Three pump connections; compatible launch sensors as listed in Chapters 4 and 7.
Supply / power / electrical limits	Basic setup powered by PC USB; optional 5-V USB-C supply, at least 0.5 A.

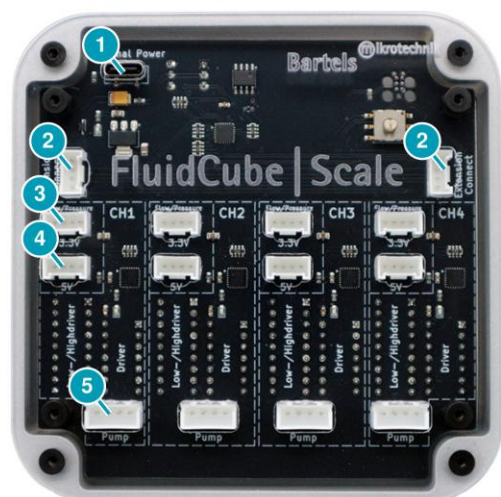
The table above summarizes the functions covered by this guide.

5 FluidCube | Scale

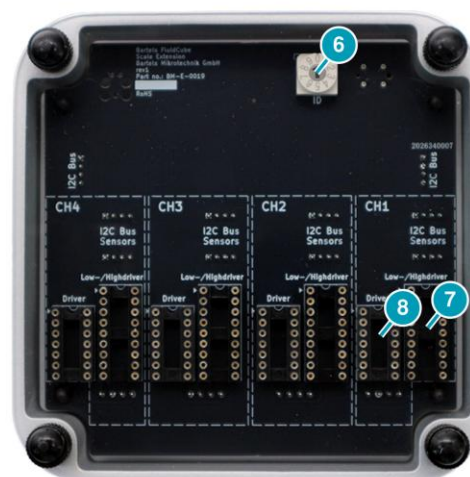
Overview

Extension for additional pump capability and pressure/flow sensing. Scale operates through Base and supports scalable, application-specific configurations.

A Scale Rev1: top



B Underside: alternative driver sockets



- 1 Optional Power
- 3 3.3V sensor port (each channel)
- 5 Pump connector (each channel)
- 7 18-pin Lowdriver / Highdriver socket

- 2 Extension Connect
- 4 5V sensor port (each channel)
- 6 ID / Extension address
- 8 14-pin mp-Driver socket

Fit only one driver per channel. CH1–CH4 outlines group the connections.

Figure 6. FluidCube | Scale connections and pump-channel driver sockets.

Connections and Controls

Use the connector labels and channel assignments below.

Connector / control	Location / identification	Function / connection
Optional Power	USB-C-shaped port	Optional 5-V USB-C supply, at least 0.5 A.
Extension Connect	Connections on both sides	Equal ports; 4-pin Grove cable; connect/disconnect unpowered.
CH1–CH4; Pump	Four labeled channel areas/pump sockets	Four pump channels, one installed driver per channel.
Flow/Pressure; 3.3V / 5V	Sensor sockets within channel areas	Per channel: SLF3S at 3.3V; ABP/SDP at 5V.
Low-/Highdriver / Driver; ID	Driver areas; selector visible	18-pin Lowdriver/Highdriver or 14-pin Driver; only one fitted per channel. Address 0–7.

Each channel has a dashed PCB outline enclosing its connectors and sockets, with a label such as "CH1" at the upper right. Its two alternative driver sockets share one pump connector.

Connecting Components

Use FluidCube | Pump Cable to connect a compatible Bartels micropump to a designated pump connection. Pressure and flow sensors are connected using the approved cables for the selected compatible models.

Use the same Pump Cable variant and pump orientation as Base. Connect SLF3S sensors to the channel "3.3V" port and ABP/SDP to "5V". The regulation sensor must belong to that pump channel.

Scale has four pump channels. Each has an 18-pin socket compatible with mp-Lowdriver or mp-Highdriver and a 14-pin socket exclusively for mp-Driver. Fit only one driver per channel. Use the same unpowered installation and dot/triangle orientation as Base.

Operation and Functionality

Scale adds pumping capability and supports pressure/flow sensing within the FluidCube configuration. Use Scale when additional pumping functions are required; configuration and component control remain centralized through Base.

Each Scale adds four pump channels with pressure/flow sensing, centrally accessed in FluidicStudio. Regulation is channel-associated on Base/Scale and requires the board license. A Scale can be licensed and regulate without licensing the pump channel on Base; Base remains necessary for system operation.

Example Configuration

Base + Scale + Pump Cable(s) + compatible pump(s), with pressure/flow sensors as required.

Technical Specifications

Property	Specification
Article number	BM-E-0019
System role	Extension for additional pump capability and pressure/flow sensing.
Compatible components / channel capacity	Four pump channels; one selected driver each.
Supply / power / electrical limits	Optional 5-V USB-C supply, at least 0.5 A; setup load determines need.

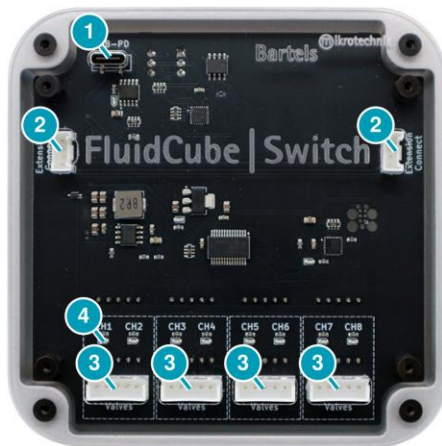
The table above summarizes the functions covered by this guide.

6 FluidCube | Switch

Overview

Specialized Extension for valve control and configurable or multiplexed fluid routing. Switch operates as part of a configuration controlled through Base.

A Switch Rev0: top



- 1 USB-PD supply
- 3 Valves: CH1/2, CH3/4, CH5/6, CH7/8
- 5 ID / Extension address
- 7 mp-valvedriverS at CH3/CH4

B Underside: installed drivers



- 2 Extension Connect
- 4 Channel LEDs
- 6 mp-valvedriverM at CH1/CH2

C Example valve wiring



One 5-pin Valves connector
per driver pair:

two monostable valves
or one bistable valve.

Align the board arrow
with the driver white dot.



Figure 7. FluidCube | Switch connections, valve-driver orientation and example valve wiring.

Connections and Controls

Use the connector labels and driver assignments below.

Connector / control	Location / identification	Function / connection
USB-PD	USB-C-shaped port	5 V for SMA or 12-V PD; solenoid requires 12 V. Fully populated: 12 V / at least 2 A.
Extension Connect	Connections on both sides	Equal ports; 4-pin Grove cable; unpowered changes only.
CH1-CH8; Valves	Eight labels above four visible valve sockets	Four 5-pin pair connectors: CH1/2, CH3/4, CH5/6, CH7/8. Two mono or one bistable per pair.
Valvedriver; ID (bottom)	Driver areas and selector	Four bottom driver sockets; arrow to white driver dot; address 0-7.

Switch has four driver sockets under the bottom plate. Align the board arrow with the driver white dot. Driver 1 serves CH1/CH2, driver 2 CH3/CH4, driver 3 CH5/CH6 and driver 4 CH7/CH8. Each pair uses one 5-pin connector labelled "Valves".

Connecting Components

Connect compatible valves to Switch using the approved valve connections and cables. Valve actuation is controlled centrally through FluidicStudio and Base.

Use mp-valvedriverM for memetis 2/2 bistable or 2/2 normally closed valves; mp-valvedriverT for Takasago 2/2 normally closed; mp-valvedriverS for the supported 3/2 solenoid valves from Bürkert, Festo and Camozzi. Bartels supplies a specific preassembled cable variant for each valve type/connector.

Populate drivers only while fully unpowered through the removed bottom plate; align arrow to white dot and refit the plate. Each driver supports two monostable valves or one bistable valve. A cable at one "Valves" connector serves the two associated channels: for CH1/CH2, pins 1/2 serve CH1 and pins 4/5 serve CH2. A bistable valve uses both channel pairs through that single connector.

Each 5-pin "Valves" connector serves its driver's two channels. Use the matching cable: two monostable valves or one bistable valve use that one connector. A bistable valve uses both channels; it does not require a second separate connector.

Operation and Functionality

Switch controls valves used to configure the fluidic path of an application. Fluid routing depends on the selected valves and the external fluidic connections; the electronic control board is not itself a fluidic manifold.

Mixed drivers are allowed with correct supply. Shared 12-V / at least 2-A PD supply is allowed for mixed SMA/solenoid population and all channels may be active simultaneously. Switch capacity is eight monostable or four bistable valves, or the corresponding mixed allocation across four drivers.

Open "Valves" in the left navigation. Detected drivers are shown. Select mono- or bistable for the relevant driver/channel pair. Monostable selection shows two on/off controls; bistable selection shows "Open" and "Close" controls for the channel pair. Monostable LED on means electrically driven, LED off means the valve normal state; physical routing depends on valve type.

For a bistable valve, CH1 sends the open pulse and CH2 the close pulse; the other channel pairs work correspondingly. The valve remains unpowered in its last switched state. LEDs indicate the last switching command, not physical feedback. When the bistable configuration is selected, the system sends a close pulse and displays "Closed". For the CH1/CH2 pair, the CH2 LED lights to indicate this close command.

If USB communication is lost while external power remains, valves retain their state, including continued electrical drive of active monostable valves. Full supply loss returns monostable valves to their normal state; bistable valves retain the last state. At power-up monostable valves are initially unpowered.

Example Configuration

Base + Switch + compatible valves in an application-specific external fluidic circuit.

Technical Specifications

Property	Specification
Article number	BM-E-0020
System role	Specialized Extension for valve control and configurable or multiplexed fluid routing.
Compatible components / channel capacity	Eight mono or four bistable, or mixed per driver pairs. M/T/S driver assignment described above.
Supply / power / electrical limits	5-V USB-C or 12-V PD as applicable; shared 12 V / at least 2 A for mixed/full setup.

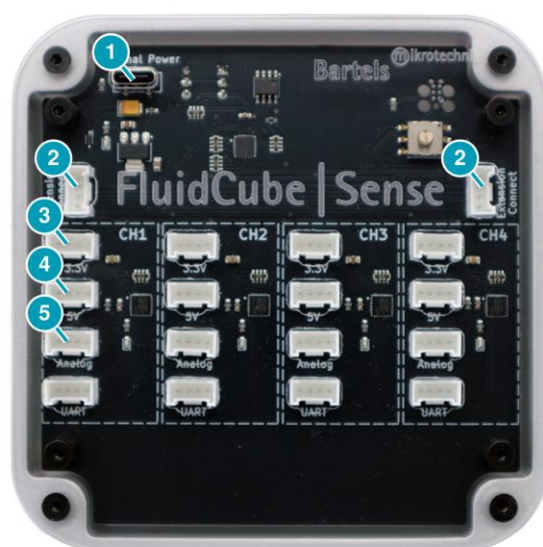
The table above summarizes the functions covered by this guide.

7 FluidCube | Sense

Overview

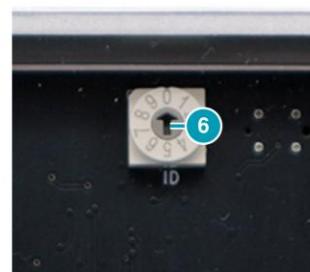
Sense supports analytical and compatible pressure/flow sensor acquisition through Base. CO₂ and VOC are additional supported launch measurements; no Fluid Control Plus regulation is possible through Sense.

A Sense Rev0: top



- 1 Optional Power
- 3 3.3V I2C sensor port
- 5 Analog sensor connection

B Address selector



CH1–CH4 group the sensor connections.

- 2 Extension Connect
- 4 5V I2C sensor port
- 6 ID / Extension address

Figure 8. FluidCube | Sense sensor connections and Extension address selector.

Sense extends sensor acquisition using analog, 3.3-V I²C and 5-V I²C connections. Current typical applications are VOC and CO₂ sensing. Compatible pressure and flow sensors can also be read through Sense, but Sense cannot supply the sensor input for Fluid Control Plus regulation.

Connections and Controls

Use the connector labels and sensor assignments below.

Connector / control	Location / identification	Function / connection
Optional Power	USB–C-shaped port	Optional 5–V USB–C supply, at least 0.5 A.
Extension Connect	Connections on both sides	Equal ports; 4–pin Grove cable; unpowered changes only.
CH1–CH4	Four labeled channel areas	Four sensor channels; one sensor per channel.
3.3V / 5V / Analog / UART	Four socket categories per channel	Digital 3.3V/5V I ² C and analog connector with 3.3–V supply. UART operation is outside this guide.
ID	Selector visible	Unique address 0–7 across all Extensions of the same Base; set unpowered.

Sense supports SLF3S–0600/–1300 at “3.3V” and ABPMANV015PG7A5/SDP810–125Pa at “5V”. It also supports Bartels SCD41–based CO₂ and SGP4X–based VOC assemblies at 5–V I²C. Bartels supplies these analytical assemblies with fluidic connections. A 3.3–V supplied analog connector is present; analog configuration and UART operation are outside this guide.

Sense provides four sensor channels. Each channel offers analog, 3.3-V I²C and 5-V I²C options; connect only one sensor using one of these options per channel.

UART-labelled connectors are outside the instructions in this guide.

Connecting Components

Connect compatible analytical sensors to Sense using the approved connection for each sensor model. Sensor values are accessed through FluidicStudio and Base.

SLF3S sensors use a 4-pin Grove-to-6-pin PicoBlade cable. ABP and SDP use directly soldered 4-pin Grove cables. The SDP assembly is precalibrated for air. Use the cable supplied for the Bartels sensor assembly.

No user-installed driver is required. Leave the bottom plate in place and attach compatible sensors to the existing connections. Sensor power is provided through those connections. Make all connections without power; add fluidic connections where the selected sensor requires them, then establish board power and data communication.

Operation and Functionality

Displayed units: SLF3S µl/min; ABP mbar; SDP sccm; SCD41 CO₂ ppm; SGP4X VOC raw ticks. All digital sensors listed use I²C. Connect sensors before applying supply.

CO₂ and VOC sensors need warm-up before reliable readings. Refer to the manufacturer datasheet for every sensor.

Sensors must be connected before applying supply. The four SLF/ABP/SDP launch sensors need no additional user preparation or zeroing for initial display; follow the applicable datasheet conditions. Home lists detected sensors; select them on Sensors to display values and graphs.

An identified sensor without valid measurement values displays "NA" on Sensors. Multiple same-type sensors can be distinguished by board and channel.

Example Configuration

Base + Sense + compatible analytical sensor(s).

Base plus Sense can acquire sensor values without a pump.

Technical Specifications

Property	Specification
Article number	BM-E-0021
System role	Specialized Extension for analytical sensing.
Compatible components / channel capacity	Four sensor channels; SLF/ABP/SDP and additional SCD41/SGP4X sensing. No Fluid Control Plus.
Supply / power / electrical limits	Optional 5-V USB-C supply, at least 0.5 A.

The table above summarizes the functions covered by this guide.

8 FluidicStudio

Bartels FluidicStudio is the central software interface for FluidCube. All connected boards, components and adjustable parameters are managed through FluidCube | Base.

Installing FluidicStudio

Download FluidicStudio v2.0.0 from <https://bartels-mikrotechnik.de/support-center/>. Install using the supplied .msix package. Launch Base firmware: 20261007; only the Base firmware version is passed to the app.

Connecting FluidCube

Connect the FluidCube configuration to the computer through Base. Software access to Extensions is provided through Base.

Connect opens the COM-port selector; after selection the board tile appears at the top. First Connect after a complete power-cycle does not activate pumps or valves.

Select the correct COM port for each Base using Connect. After total power loss pumps, regulation and dosing do not restart automatically. With external supply retained, USB loss allows manual pumps, regulation, dosing and valves to continue; the app does not mirror their hardware states on reconnect. For the reconnection workflow in this guide, disconnect the PC and all external supplies, wait a few seconds, then connect the PC followed by external supplies and Connect in the app. Do not assume an inactive app display means powered hardware is stopped. Full power-cycling leaves pumps, regulation and dosing off; bistable valves keep their physical state.

FluidCube Device Overview

Home lists detected boards, pump drivers and sensors. It provides license-request and activation access and displays the licensed-channel count.

For the Home overview and COM-port selection, see the connection screenshot in Chapter 1.

Top tiles select connected Base environments. "Pumps", "Valves", "Sensors" and "Fluid Control Plus" operate the selected setup. Home lists detected hardware; operational controls are on the corresponding pages. The tile three-dot menu provides rename, board information and Base update access. Licensing uses the request wizard and Enter Key on Home; see Section 8.8.

Save/Load includes pump settings, selected sensors and valve settings. Warning: Load can automatically restore pump operation or an active valve state saved previously. Check the saved state and connected fluidic setup before loading. This guide covers settings saved with pumps, regulation, dosing and valve actuation stopped; restoration of running regulation or dosing is outside this workflow. Load is not a stop function.

Pump Control

Pumps connected through Base or Scale are controlled in FluidicStudio through Base.

For BP7 with mp-Lowdriver and water, use the Quick Start settings of 150 Vpp / 100 Hz. The driver entry provides sliders/input fields for amplitude and frequency and an on/off button.

For the manual pump controls, see the screenshot in Chapter 1.

Only populated, identified drivers are usable. Only detected drivers are displayed. Base supports three driver/pump entries, Scale four channels with one installed driver each. Use the corresponding on/off button for manual start/stop.

Sensor Readout

Base/Scale and Sense can read compatible pressure/flow sensors. Built-in regulation uses only the channel-associated sensors on Base/Scale.

Sensor compatibility and units are described in Chapter 7. "NA" identifies an invalid reading from a detected sensor.



1 Pressure Plot icon: enabled (blue)

2 Flow Plot icon: disabled (grey)

Both numeric readings are visible; only pressure is plotted.

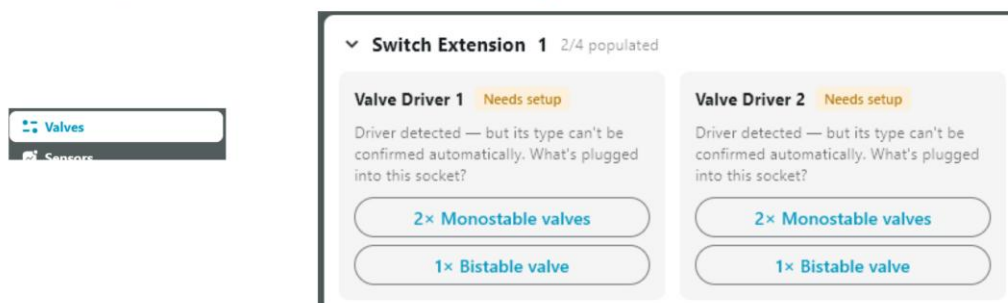
Figure 9. Sensor readings in FluidicStudio. Pressure plotting is enabled; flow plotting is disabled.

In Sensors, select available sensors for numeric live values and graphs. Multiple same-type sensors can be distinguished by board and channel.

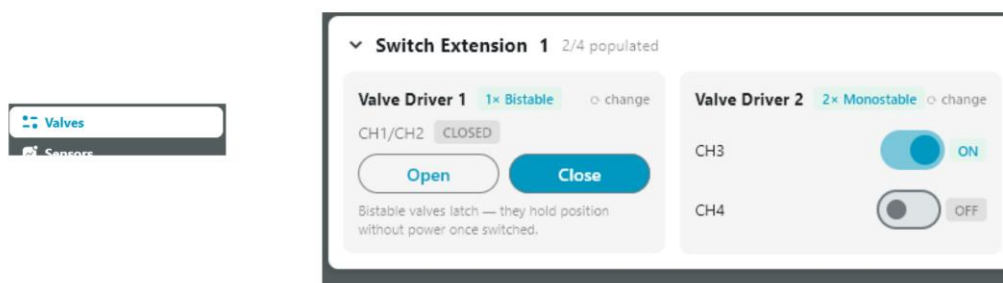
Valve Control

Switch provides valve control for the external fluidic routing configuration. Valve operation is managed centrally through FluidicStudio and Base.

A Detected drivers: select the valve configuration



B Bistable and monostable controls



CH1/CH2: bistable Open / Close; CH3 and CH4: monostable ON / OFF.

The displayed bistable state indicates the switching command.

Figure 10. Selecting the valve configuration and operating bistable and monostable valves in FluidicStudio.

Open "Valves", identify the driver and select monostable or bistable. Monostable selection provides separate on/off controls for each of the two channels; bistable selection provides "Open" and "Close"

controls using both channels. LEDs show electrical drive for mono and last switching command for bistable. See Chapter 6 for supply-loss and communication-loss behavior.

Fluid Control Plus

Fluid Control Plus is the license-enabled regulation and dosing area in FluidicStudio.

Monitor actual sensor values and the fluidic process while regulating or dosing. An "NA" reading is not a valid measurement. Use Stop to end the function when needed; do not assume sensor errors cause an automatic stop.

All seven functions are available for customer activation at launch on Base/Scale. Required sensor and driver: Highflow—SLF3S/mp-Driver; Lowflow—SLF3S/mp-Lowdriver; Indirect Flow—SLF3S/mp-Highdriver; Dynamic and Static Pressure—ABP/mp-Highdriver; Gasflow Control—SDP/mp-Highdriver; Volume Dosing—SLF3S/any of the three pump drivers. The sensor must be connected to the same Base or corresponding Scale pump channel; Sense cannot provide the regulation sensor. On Fluid Control Plus, select the function for the licensed channel, enter the target in the indicated unit and use the channel start control. Use Stop to end regulation or dosing.

Flow targets use $\mu\text{l}/\text{min}$, pressure targets mbar, gasflow targets sccm and dosing volume μl . Lowflow typically operates below 1,000 $\mu\text{l}/\text{min}$; SLF3S-0600 is preferred and has the measuring range $\pm 2,000$ $\mu\text{l}/\text{min}$. Pressure entry has no upper input limit; this is not an achievable-pressure rating. If a target cannot be reached, the pump continues at its minimum/maximum achievable operating point without an app warning. Monitor values and stop as needed. Volume Dosing stops automatically at the target volume and reports completion. Stop can end regulation or dosing at any time and fully stops the pump.

Licensing

Activation is bound permanently to hardware, not the PC. It remains available after a PC change and for the corresponding licensed Serial Commands.

Licenses are bound to individual boards rather than PCs. A licensed board can be used on another computer without repeating activation. A license on Base is not required to regulate on a licensed Scale; Base remains the mandatory system hub.

1. Keep every board to be licensed physically connected and connected in the app during both request and activation.
2. On Home, select "Unlock features" to open the license-request wizard. Select "FluidControl Plus", then the required license tier and any board selection shown by the wizard. Keep all boards to be licensed connected.
3. Use "Copy Email Text" or "Open Email Program" to prepare the request. Complete the generated email text and send it to Bartels Sales. Bartels supplies the activation code.
4. On Home, select "Enter Key", paste the activation code supplied by Bartels and select "Apply". The licensed-channel count is displayed on Home and the corresponding Fluid Control Plus controls become available.

The same board license is required for built-in regulation through Serial Commands. Regulation commands are documented but have no regulation function on an unlicensed board. Activate using FluidicStudio before using the licensed regulation through custom software.

A Select the license tier

Request License — FluidCube

Select a license tier:

- ☒ **1 Channel**
FluidCube Base channel only
- ☐ **3 Channels**
FluidCube Base channel + 2 channels on one Scale extension
- ☐ **5 Channels**
FluidCube Base channel + a full Scale extension (4 channels)
- ☐ **Flatrate**
Unlock any channel on any extension for this FluidCube Base

Cancel Back Request License

B Prepare the request email

Request License Key

Choose an action: Copy the email text or open your email program.
Please send your request to: sales@bartels-mikrotechnik.com

Copy Email Text Open Email Program

C Enter the key supplied by Bartels

Enter License Key — FluidCube

Cancel Apply

Keep every board to be licensed connected during request and activation.

Enter the activation key supplied by Bartels, then select Apply.

Figure 11. Requesting a Fluid Control Plus license and entering the activation key supplied by Bartels.

Software and Firmware Updates

Download software and firmware from <https://bartels-mikrotechnik.de/support-center/>. The following update procedure applies to Base in FluidicStudio v2.0.0.

Download and unpack the Base update package from the Support Center. Open the Base tile three-dot menu and choose Update. Select the unpacked folder containing all update files, then start the update. Wait for the progress indicator to reach 100% and for the success message.

Manual stopping of every function is not required before the update. Base restarts afterward; powered Extensions continue running, and their states are not mirrored in the app. After success, perform a full setup power-cycle: disconnect the PC and all supplies, wait a few seconds, then reconnect PC followed by external supplies. Pumps, regulation and dosing stay off after this restart; bistable valves keep their physical state. If the update fails or no success message appears, contact Bartels.

9 Serial Commands

Use the separate customer Serial Command reference for Base firmware 20261007, available at <https://bartels-mikrotechnik.de/support-center/>. This guide gives the communication settings for custom-software access; command syntax, responses and examples are covered by that reference.

Serial Interface

Use the Base serial COM port with the settings below.

Custom software can use the documented Serial Commands instead of FluidicStudio for normal operation. Use the released reference for the installed firmware version. FluidicStudio is used for hardware-license activation.

Built-in regulation and dosing commands require the corresponding Fluid Control Plus activation on Base/Scale. Activate the boards using FluidicStudio before using those licensed functions from custom software.

Communication Settings

Setting	Value
Baud rate	115200
Data bits	8
Parity	None
Stop bits	1
Flow control	None
Line termination	CRLF required; bare LF not accepted

Use 115200 Baud, 8 data bits, no parity, 1 stop bit and no flow control. End every command with CRLF (`\r\n`); LF alone does not terminate a command. Lowercase ASCII letters are converted to uppercase and null bytes are ignored.

Command Reference

Obtain the customer Serial Command reference from the Bartels Support Center. Developer/service commands are outside this guide.

10 Important Notices

This operating manual contains necessary instructions for the installation, commissioning, operation and maintenance of the The Bartels Pump | BP7-series. The manual is intended to help you achieving optimal results in a short time and shall also assist avoiding possible sources of errors. The operating manual of the controllers and the accessories are available separately.

The products have been designed with state-of-the-art technology and in accordance with all relevant safety regulations. However, a risk of damage to the units, other property, the operator and/or other persons cannot be fully excluded.

Always ensure that specialized and trained personnel will comply with the following general instructions. Therefore, please keep this manual and hand out copies as required.

All values are approximate and no guarantee of specific technical properties.
Changes in the course of technical progress are possible without notice.

Warranty

The The Bartels Pump | BP7 micropumps have been developed for the transport of gases or liquids. The controllers have been developed for operating the The Bartels Pump | BP7 micropumps. Bartels Mikrotechnik can assume no liability for damages resulting from the pump media. This applies especially for hazardous fluids.

The The Bartels Pump | BP7 micropumps must be operated with Bartels Mikrotechnik electronics. Bartels Mikrotechnik GmbH cannot guarantee the proper work of the units with customer specific electronics. If other controllers than the ones from Bartels Mikrotechnik are used, Bartels Mikrotechnik disclaims any warranty.

Bartels Mikrotechnik assumes no liability for abnormal handling, improper or negligent use of the The Bartels Pump | BP7 micropumps and the controller that is not conform to the specified purpose of the system. This applies especially for micropump controllers, components and systems of other manufacturers, which have not been certified by Bartels Mikrotechnik.

We guarantee that the The Bartels Pump | BP7 micropumps comply with the actual state of scientific and technical knowledge and due to this, the operational risks are limited to a minimum.

Bartels Mikrotechnik GmbH warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be of the quality, material and workmanship defined in Bartels Mikrotechnik GmbH published specifications of the product. Within such period, if proven to be defective, Bartels Mikrotechnik GmbH shall repair and/or replace this product, in Bartels Mikrotechnik GmbH's discretion, free of charge to the Buyer, provided that:

1. notice in writing describing the defects shall be given to Bartels Mikrotechnik GmbH within fourteen (14) days after their appearance
2. such defects shall be found, to Bartels Mikrotechnik GmbH's reasonable satisfaction, to have arisen from Bartels Mikrotechnik GmbH's faulty design, material or workmanship
3. the defective product shall be returned to Bartels Mikrotechnik's factory at the Buyer's expense
4. the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

This warranty does not apply to any equipment which has not been installed and used within the specifications recommended by Bartels Mikrotechnik GmbH for the intended and proper use of the equipment.

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Warning, Personal Injury

Bartels Mikrotechnik GmbH rejects any responsibility for damages to persons or property resulting from non-compliance with the instructions in this manual. In this case all warranties shall be void.

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury. If the Buyer shall purchase or use Bartels Mikrotechnik GmbH products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless Bartels Mikrotechnik GmbH and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if Bartels Mikrotechnik GmbH shall be allegedly negligent with respect to the design or the manufacture of the product.

Moreover, please note that components of the controller and pump are operating with high voltage. Therefore, persons wearing pacemakers are recommended to avoid the operating system. Do not open the housing of the micropump and the controllers.

The use of liquids, which may alone or in combination create explosive or otherwise health-endangering conditions (including vapors) is not permitted.

All work in connection with the installation, assembly, commissioning/decommissioning, disassembly, operation, servicing, cleaning and repairing of the pump and the controller must be carried out by qualified, suitably trained and instructed personnel. Work on electrical components and assemblies must be carried out by supervised personnel with the necessary qualifications and skills, after verifying that the components do not lead residual voltage or charge and in a dry environment.

We guarantee that the micropumps comply with the actual state of scientific and technical knowledge and due to this, the operational risks are limited to a minimum.

ESD Precautions: The inherent design of the active electronic components, i.e. mp-Lowdriver, -Highdriver, -Highdriver4, Valvedriver and -Labtronix causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product.

11 Company information



Bartels Mikrotechnik is a globally active manufacturer and development service provider in the field of microfluidics. In the microEngineering division, the company supports industrial customers in the modification, adaptation and new development of high-performance and market-oriented product solutions through the innovative means of microsystems technology. The second division, microComponents, produces and distributes microfluidic products and systems, especially for miniaturized and portable applications. Our key products are micropumps that convey smallest quantities of gases or liquids and are used in a variety of ways in biotechnology, pharmaceuticals, medical technology and numerous other applications.

Bartels Mikrotechnik with passion for microfluidics!

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